

Appl. No. 09/847,554
Amdt. Dated December 18, 2003
Reply to Office Action of September 25, 2003

REMARKS

Claims 1-20 are currently pending. The Applicant is herein amending claims 1, 2, 4, 5, 7, 13, 14, 16, and 20. The Applicant notes that the amendments are not intended as narrowing amendments. Rather, the amendments are intended to broaden or maintain the scope of the originally filed claims.

The Applicant kindly requests the Examiner to acknowledge the priority claim to U.S. Provisional Application No. 60/201,215, filed May 2, 2000.

The Examiner's indication of allowable subject matter in reference to claim 12 is noted with appreciation.

Claims 1-6, 13-15, 18-20 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Izadpanah (U.S. Patent Application No. 10/160,986) in view of Barber (U.S. Patent No. 6,242,989), and in further view of Sievenpiper (U.S. Patent No. 6,538,621).

The Applicant traverses this rejection.

As a preliminary matter, the Applicant does not concede that any of these three references have an effective date that is prior to the Applicant's date of invention. Nor does the Applicant concede that the three-way combination is proper in light of MPEP § 2143.01, which states: "The mere fact that references can be combined or modified is not sufficient to establish prima facie obviousness." However, in order to move this case to allowance, the Applicant will now discuss deficiencies of the references.

In order for the references to render the claimed invention unpatentable, the references, when taken as a whole, must disclose or otherwise suggest each and every limitation recited in the claims. MPEP § 2143. None of the cited references, whether alone or in combination, satisfy this standard.

The Applicant's independent **claim 1** defines an "RF-actuated microelectromechanical systems (MEMS) switch module." The module includes a "MEMS switch element" and an antenna for "receiving an externally-generated RF control signal." At least two switching ports of the MEMS switch element "are actuated when said externally-generated RF control signal is received at said antenna."

The Applicant's independent **claim 13** defines an "RF-actuated microelectromechanical

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systems (MEMS) switch module." The module includes a "MEMS switch element" and an antenna for "receiving an externally-generated RF control signal." Two switching ports of the MEMS switch element "are alternately connected to and disconnected from one another when said externally-generated RF control signal is received at said antenna."

The Applicant's independent **claim 18** defines a "selectively changeable radio frequency (RF) element." The element includes at least two RF sub-elements electrically connectable to one another by "an RF-actuated MEMS switch." The RF-actuated MEMS switch for "receiving an RF control signal ... and, in response thereto, selectively connecting said at least two sub-elements."

Thus, an "RF-actuated" MEMS switch or switch module is claimed, where an "RF control signal" is used to actuate the MEMS switch. Such an RF-actuation scheme provides a number of benefits over conventional actuation schemes where MEMS switches are controlled by external DC bias lines. As is explained herein, each of the cited references merely discloses conventional actuation.

Izadpanah discloses a switchable front end for an RF transceiver that utilizes MEMS switches in the switching network to reduce losses in the filter network. MEMS switches are also utilized in a dipole antenna to reconfigure its length for use at different frequencies (para. #0023 and 0025). In all the applications proposed by Izadpanah, the MEMS switches are simply controlled by external DC bias lines, as is conventionally done. The Applicant can find no occurrence where Izadpanah discloses or suggests an application where MEMS switches are actuated or otherwise controlled by an applied RF signal or even by the RF signal that is switched by the MEMS switches themselves.

For the purpose of clarity, note that Izadpanah's use of the term "RF" is in reference to the transmit and receive signals being switched by the MEM switch, and not an actuating signal. For example, Izadpanah discloses that "RF MEM switches 16, 18 and 20" are configured to open and close the desired signal path for either transmit or receive mode (para. #0018). Also, Izadpanah discloses that "antenna 12" is common to both the transmit and receive paths" (para. #0015). With regard to actuation, however, Izadpanah merely discloses that MEM switches are associated with a conventional "simple actuation technique" (para. #0027), where the MEMS switches are actuated by external DC bias lines. Izadpanah's MEMS switches are not RF-actuated.

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Izadpanah therefore fails to disclose an antenna for "receiving an externally-generated RF control signal" as recited in the Applicant's claims 1 and 13. Likewise, Izadpanah fails to disclose an "RF-actuated MEMS switch receiving an RF control signal at a predetermined frequency and, in response thereto, selectively connecting said at least two sub-elements" as recited in the Applicant's claim 18. Other deficiencies associated with Izadpanah will be apparent in light of this response.

For example, Izadpanah fails to disclose a "receiver" operatively connected to an antenna for receiving an externally-generated RF control signal, where the receiver is for receiving the antenna output signal and generating a DC voltage representative thereof" as recited in Applicant's claim 1. In addition, and as correctly noted by the Examiner, Izadpanah fails to disclose or suggest an externally-generated RF control signal having wavelength of approximately one millimeter as recited in Applicant's claim 12. Also correctly noted by the Examiner is that Izadpanah fails to disclose or suggest a "tuned circuit" or a "detector" as recited in Applicant's claims 2 and 13.

To correct this last deficiency, the Examiner cites Barber and Sievenpiper. In particular, the Examiner cited Barber as disclosing a tuned circuit, and Sievenpiper as disclosing a detector. However, just as with Izadpanah, Barber and Sievenpiper each fail to disclose an antenna for "receiving an externally-generated RF control signal" as recited in the Applicant's independent claims 1 and 13. Likewise, Barber and Sievenpiper each fail to disclose an "RF-actuated MEMS switch receiving an RF control signal at a predetermined frequency and, in response thereto, selectively connecting said at least two sub-elements" as recited in the Applicant's independent claim 18.

In more detail, Barber discloses a multi-port variable capacitor device using MEMS switching functionality. The device is controlled by two different input bias voltages that cause the arm of a MEMS switch to balance at variable distances above the bottom contact pad. The capacitance between the arm and the pad is controlled by the distance between the contacts. (col. 4, lines 11-44; Figures 3-4). By balancing the arm over a fulcrum and using two separate external control voltages, one can make the arm behave as a "seesaw" whereby one side can have high capacitance while the other side is low and vice versa. (col. 4, lines 57-67; Figures 5-8). However, just as with Izadpanah, Barber simply utilizes conventional DC bias lines to actuate the MEMS switch.

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Sievenpiper discloses a method to create a high impedance RF reflective surface (sometimes referred to as a Frequency Selective Surface or FSS) in which the phase of the reflected signal can be locally adjusted. The contacts of MEMS switches are modified in such a way as to function as a switchable capacitor. (col. 4, lines 32-43; col. 5, lines 36-47; Figure 6). Therefore the reflective structure can be retuned by switching the MEMS devices. The actuation signals for the MEMS devices are brought to the devices through conventional bias control lines entering through vias from the rear of the ground plane. (col. 5, lines 44-47). A second approach disclosed is to connect the conventional bias control lines directly to metallic FSS elements to which the MEMS switches are connected. (col. 6, lines 36-40). Thus, just as with Izadpanah and Barber, Sievenpiper simply utilizes conventional DC bias control lines to actuate the MEMS switches.

The Applicant submits, therefore, that when taken individually or in combination, the cited references of Izadpanah, Barber, and Sievenpiper fail to disclose or suggest each and every limitation of the claimed invention. As such, the Applicant further submits that claims 1-6, 13-15, and 18-20 are patentably distinct over the cited references.

For at least these reasons, the Applicant respectfully requests that this rejection be withdrawn.

Claims 7, 11, and 16-17 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Izadpanah in view of Barber, in further view of Sievenpiper, and in further view of Huang (U.S. Patent No. 6,383,353).

As a preliminary matter, the Applicant does not concede that Huang has an effective date that is prior to the Applicant's date of invention. Nor does the Applicant concede that the four-way combination is proper in light of MPEP § 2143.01.

In addition, the Applicant traverses this rejection for at least the reasons previously explained in reference to independent claims 1 and 13, in that when taken alone or in combination, the cited references fail to disclose or suggest each and every limitation recited in these claims, as well as their respective dependent claims, 7, 11, and 16-17.

Huang discloses a MEMS switch that has contacts in the form of conductive vias penetrating the substrate on which the switch is fabricated. (Abstract). Huang also discloses

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methods of encapsulating the device. (Abstract). Various materials and their properties are described that could be used for the encapsulation. However, there is no disclosure or suggestion of an encapsulating material being transparent to an RF-actuation signal to allow the MEMS switch to be RF-actuated. Indeed, and just as with the other cited references, Huang simply discloses conventional actuation of the MEMS switch.

Claims 8-10 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Izadpanah in view of Barber, in further view of Sievenpiper, in further view of Huang, and in further view of True (U.S. Patent Application No. 09/767,632).

As a preliminary matter, the Applicant does not concede that True has an effective date that is prior to the Applicant's date of invention. Nor does the Applicant concede that the five-way combination is proper in light of MPEP § 2143.01.

In addition, the Applicant traverses this rejection for at least the reasons previously explained in reference to independent claim 1, in that when taken alone or in combination, the cited references fail to disclose or suggest each and every limitation recited in independent claim 1, as well as its respective dependent claims, 8-10.

True discloses a multilayer construction technique for the fabrication of a MEMS switch or switching mirror. (Abstract). In particular, True describes making the mirror layer opaque so that the optical illumination does not excite photoconductors in the layers below that could interfere with the electronic circuits there. (para. #0034). However, just as with the other references, there is no disclosure or suggestion of an RF-actuation signal to allow the MEMS switch to be RF-actuated.

In addition, the Examiner concedes that each of the cited references fail to disclose or suggest a MEMS module that is connected to an active or passive microwave antenna element as recited in claims 9 and 10, respectively. To correct this deficiency, the Examiner takes Official Notice. The Applicant respectfully disagrees with the Examiner, particularly because the limitation of a microwave antenna element is used in the context of other limitations (e.g., "an antenna for receiving an externally-generated RF control signal ... whereby said at least two switching ports of said MEMS switch element are actuated when said externally-generated RF control signal is received at said antenna"), which are also not disclosed or suggested by any of the cited references, as previously explained herein.

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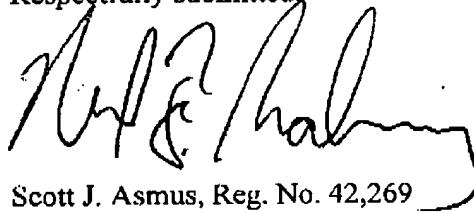
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As such, the Applicant kindly requests that the Examiner provide a reference showing this limitation in the context of the claimed invention in accordance with MPEP § 2144.03, which states that "assertions of technical fact in areas of esoteric technology must always be supported by citation of some reference work" and "allegations concerning specific knowledge of the prior art, which might be peculiar to a particular art should also be supported." MPEP § 2144.03

The Applicant believes the above amendments and remarks to be fully responsive, thereby placing this application in condition for allowance. Favorable action is solicited. The Examiner is kindly invited to contact the undersigned attorney by telephone, facsimile, or email for quickest resolution, if there are any remaining issues.

Respectfully submitted,



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